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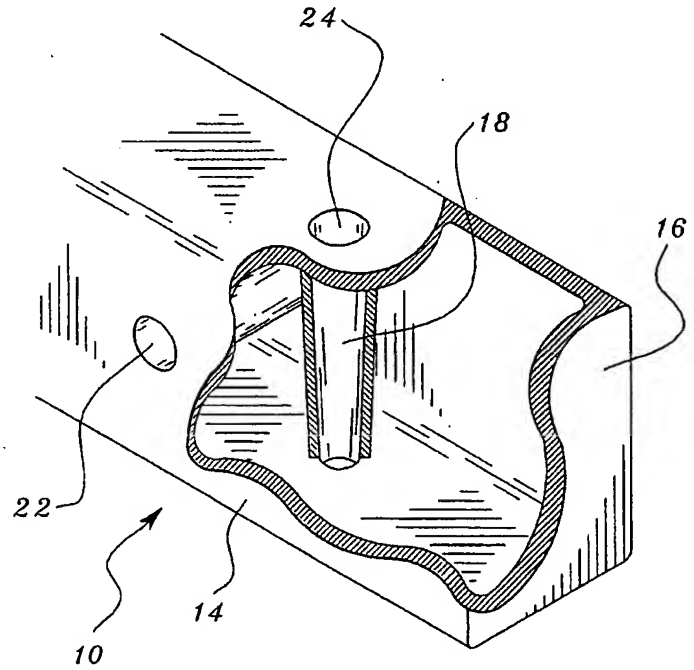
(54) Title: CROSS ARM FOR UTILITY POLES

(57) Abstract

A cross arm (10) for utility poles (12) is made of synthetic materials including ground–up automotive tires, overspray from painting booths, and a binder material such as polyethylene, and is formed by a rotational molding process. The cross arm (10) is hollow with closed ends (16), and includes internal tubular struts (18) or braces; the tubular struts (18) extend through walls (14) of the cross arm (10) to provide apertures (22, 24) for mounting bolts and for attachment of insulators and the like for supporting electrical distribution lines and telephone cables.



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CROSS ARM FOR UTILITY POLES

Technical Field

This invention relates to cross arms for utility poles which support electric distribution lines and telephone lines, and particularly to such cross arms made from a composite material including recycled material from automotive tires and other by-products from the automotive industry.

Background Art

Utility pole cross arms made of treated wood have an average life expectancy of five to six years. Wooden cross arms are especially subject to damage by woodpeckers. They are also broken by overloads of ice, attacked by insects, and damaged by weathering. Because of their relatively short life span, replacing wooden cross arms is a significant maintenance problem for utility companies. Weighing forty pounds or more, wooden cross arms require a minimum of two workers and a bucket truck to effect a replacement. Working aloft is dangerous; each wooden cross arm replaced represents a chance for injury to workers. After the chemically-treated wooden cross arms are replaced, disposing of them in an environmentally safe manner presents a final problem.

Another problem is that wooden cross arms supporting electrical lines may provide a portion of the path by which current "leaks" from the conductors to ground. This problem is more acute when cross arms are wet. Traces of electrical arcing, i.e., carbon tracks, are often found on wooden cross arms around insulator mountings.

A need exists, therefore, for a utility-pole cross arm which has a longer period of usefulness, and which is not subject to the problems affecting cross arms made of wood.

Disclosure of the Invention

The present invention solves the problems outlined above by providing a cross arm made of synthetic material. Strong and lightweight, the synthetic cross arms are

resistant to the problems that plague wooden cross arms, especially damage by birds and insects. They are also resistant to the effects of ultraviolet light, ozone, and salt water. Their light weight, about 16 pounds for an eight-foot cross arm, makes them easier to handle and therefore safer to install and to replace. The synthetic material imparts a degree of flexibility to the cross arms, so they can bend without breaking when subjected to an increased load such as ice-coated lines. In addition, the new cross arms are resilient, returning to a near-normal shape after an increased load is removed.

The cross arm is a molded, hollow rectangular structural member with a closed interior. A powdered mixture of plastics, including high-density polyethylene, ground-up material from recycled tires, and drier solids (overspray from paint booths) is the raw material from which the cross arms are molded. Vertical and horizontal struts inside the hollow structure provide internal bracing. The struts are tubular, with the hollow tubes providing apertures in the structural member for inserting mounting bolts and for attaching line hangers.

Based on the above, it is an object of this invention to provide an improved, lightweight cross arm for utility poles.

A further object of this invention is to benefit the environment by providing a cross arm made in part from recycled automotive tires and drier solids from the automotive industry.

Another object is to provide a cross arm which is resistant to the effects of weathering and attacks by insects and birds.

The specific nature of the invention, as well as other objects, uses, and advantages thereof, will clearly appear from the following description and from the accompanying drawings, the different views of which are not necessarily scale drawings.

BRIEF DESCRIPTION OF THE DRAWINGS:

Figure 1 is a detail showing an end portion of a cross arm with vertical and horizontal internal struts; the amount of taper shown on the struts is exaggerated.

Figure 2 is a front elevation of a cross arm mounted on a utility pole, illustrating

placement of apertures for a mounting bolt and angled braces.

Figure 3 is a top plan view of a cross arm, illustrating placement of apertures for attachment of hangers.

Figure 4 is a cross section on view 4-4 of Fig. 3 showing an internal strut and the integral hanger attachment tube.

Figure 5 is a cross section on view 5-5 of Fig. 2 showing an internal strut and integral mounting tube.

Figure 6 is a cross section on view 6-6 of Fig. 2 showing an internal strut and its integral mounting tube for an angled brace.

Figure 7 illustrates cross arms in place on a series of utility poles.

Best Mode for Carrying Out the Invention

Referring now to the drawings, Fig. 1 is a cut-away detail showing a portion of cross arm 10; Fig. 2 illustrates a cross-arm 10 mounted on a utility pole 12, and Fig. 7 shows cross arms 10 mounted on a series of utility poles 12. This disclosure generally describes the most commonly used size of cross arm, having dimensions of 8' x 3¾" x 4¾", but also applies to cross arms having other dimensions.

Raw material for the cross arm includes a percentage of shredded or ground-up tires from automobiles, trucks, tractors, airplanes, etc. Exemplary additional components of the mixture include high-density polyethylene, drier solids, and reinforcing fibers such as fiberglass. Drier solids, a by-product of automotive painting, are recycled paint particles collected from paint booths.

Cross arms 10 are molded using a rotational molding process in which the first step is loading a charge of powdered raw material into a mold. A group of molds, assembled in arrays or banks, is mounted on the end of a heavy arm which supports the mold assembly and rotates it in a bi-axial rotation. The rotational molding carousel has three arms and three main stations; the stations are for (1) loading and unloading the mold; (2) heating; and (3) cooling. During the heating and cooling stages, the mold array is continuously rotated about two axes by the rotational arm, so that the powdered charge inside the mold is distributed evenly. As the temperature of the mold increases, the charge begins to fuse. Continuous rotation maintains an even distribution

of the charge as layers of material build up on the inner surface of the mold, until all the material in the charge has been deposited evenly against the inner wall of the mold.

After the mold has reached sufficient temperature (about 650°F) so that the binder in the charge is melted, the carousel makes one-third of a rotation and the arm supporting the mold assembly moves into a cooling area. In the cooling area or chamber, the molds are first cooled in a stream of air, then by a water shower; the last step is another stream of air to dry and further cool the molds.

Another one-third rotation of the carousel brings the cooled mold assembly to the load/unload station, where the new cross arms are removed from the molds and stacked flat while they continue cooling. Then the molds are reloaded with a fresh charge of powdered raw material. An advantage of the rotational molding process is that the cross arms produced thereby are largely free of internal stresses and variations in wall thickness produced by other structural forming methods.

A small vent in the wall of each cross arm 10 is necessary for the escape of gases during the molding process and during cooling. The vent, about 0.5" diameter, is plugged by a plastic plug after the cross arm is cooled; the plug is mechanically rotated against the cross arm wall 14 until the heat of friction partially fuses the plug material, welding the plug to the cross arm material. Thus the interior space of the cross arm is sealed off from penetration by water, and from any communication with the outside atmosphere.

Removal of the completed cross arms 10 from their molds is facilitated by use of a water-based mold release agent. Teflon-coated molds may also be used to ease the extraction process.

Internal struts 18 reinforce the walls of cross arm 10, allowing the use of a hollow structure. The struts 18 are tubular, with a slight taper as described below. The interior of each strut tube provides an aperture for receiving mounting bolts and other hardware, including supports for electrical insulators or supports for telephone cable. Such supports are referred to herein as "hangers." Each end of strut 18 is integral with an outer wall 14 of cross arm 10. Some struts 18 are horizontal, passing through the narrower dimension of the cross arm, defining mounting apertures 22 for receiving mounting bolts and brace bolts. Vertical struts 18, through the wider

dimension of the cross arm, define hanger apertures 24 for receiving attachments for hangers. Placement of vertical struts and their associated hanger apertures is shown in Fig. 3.

Referring again to Fig. 1, cross arm 10 is rectangular in cross section, with walls 14 and end walls 16. Of approximately equal thickness, the top, bottom, and side walls of the cross arm form a hollow, rectangular structural member. Each end of cross arm 10 is closed by an end wall 16. Thickness of tube walls 20 of struts 18 is substantially the same as that of walls 14, about 5/16". For cross arms designed to support heavier loads, the wall thickness is commensurately greater.

Removable pins are used in the mold as mandrels around which tubular struts 18 are formed. Openings in the mold walls receive the pins; prior to charging the mold with powdered raw material, the pins are inserted through the mold so that the pins extend through two opposite walls of the mold. After cooling, the pins are removed before the cross arm is extracted from the mold. A slight taper in the pins, about 2°-3°, allows the pins to be easily withdrawn from the newly-molded cross arm. In the drawings, especially Figs. 4, 5, and 6, the amount of taper is exaggerated for clarity. Dimensions of the pins are designed to leave an aperture suitable for receiving mounting bolts and other hardware, including attachments for hangers. As seen in Figs. 4 and 5, apertures for hangers and for mounting bolts are approximately the same diameter; these pass through the wider and narrower dimensions, respectively, of cross arm 10. Fig. 6 illustrates an aperture for attaching an angled mounting brace 11; this aperture is smaller in diameter than the others.

Tube walls 20 resist the pressure of the various hardware just described, especially the compressive forces generated when threaded attachments are bolted to the cross arm. In addition, the tube walls 20 brace the hollow cross arm against bending stresses. Walls of vertical tubes, and to a lesser extent horizontal ones, help the cross arm resist vertical bending stresses imposed by supported loads.

The restrictive description and drawings of the specific examples above do not point out what an infringement of this patent would be, but are to enable one skilled in the art to make and use the invention. Various modifications can be made in the construction, material, arrangement, and operation, and still be within the scope of our

invention. The limits of the invention and the bounds of the patent protection are measured by and defined in the following claims.

We claim as our invention:

1. A cross arm for utility poles, comprising:

an elongate hollow structural member having two ends, a top, a bottom, a front and a back,

said member being made of composite synthetic material,

said member having a plurality of internal tubular struts therein, each said tubular strut being integral with said structural member, and

at least one said tubular strut defining an aperture in said structural member, said aperture being in a predetermined location on said structural member.

2. The invention as described in Claim 1, further comprising:

said composite synthetic material including particles of automotive tires and a binder material.

3. The invention as described in Claim 2, wherein said binder material is polyethylene.

4. The invention as described in Claim 1, further comprising:

said composite synthetic material including particles of automotive tires and drier solids and a binder material.

5. The invention as described in Claim 1, wherein each said end of said hollow structural member is closed by an end wall so that an interior of said structural member is sealed off from communication with a surrounding atmosphere.

6. The invention as described in Claim 1, further comprising:

at least one of said apertures being an interior of a tubular strut extending from said front of said member to said back of said member, and

at least one of said apertures being an interior of a tubular strut extending from

said top of said member to said bottom of said member.

7. The invention as described in Claim 1, further comprising:

said member including an outer wall surrounding a hollow interior of said member, and

said tubular strut extending through said hollow interior.

8. The invention as described in Claim 1, further comprising:

said composite material including high-density polyethylene.

9. The invention as described in Claim 1, further comprising:

said composite material including a portion of reinforcing fibers.

10. A method of making a utility-pole cross arm, comprising the following steps:

providing an elongate mold rectangular in cross section, said mold including removable pins inserted therethrough,

mixing a raw material,

loading said mold with a measured charge of said raw material,

simultaneously rotating and heating said mold to a temperature sufficient for said raw material to partially fuse,

cooling said mold, and

removing a molded cross arm from said mold.

11. The method as described in Claim 10, wherein said raw material includes fragments of automotive tires.

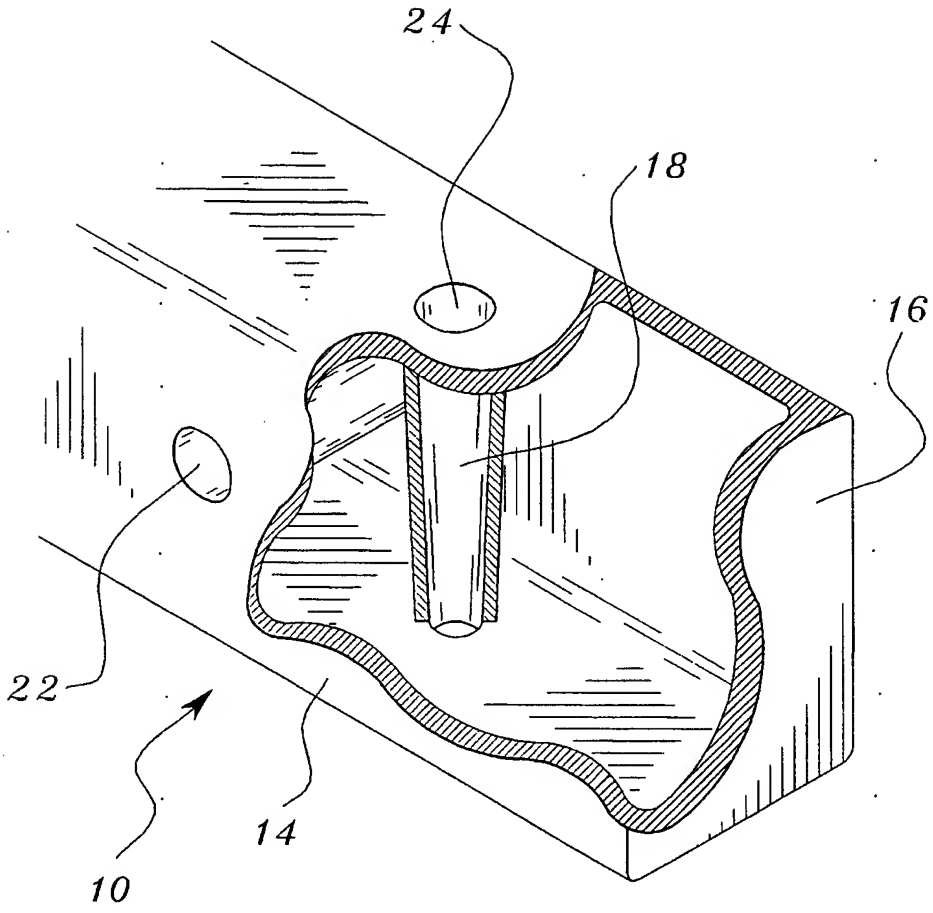


Fig. 1

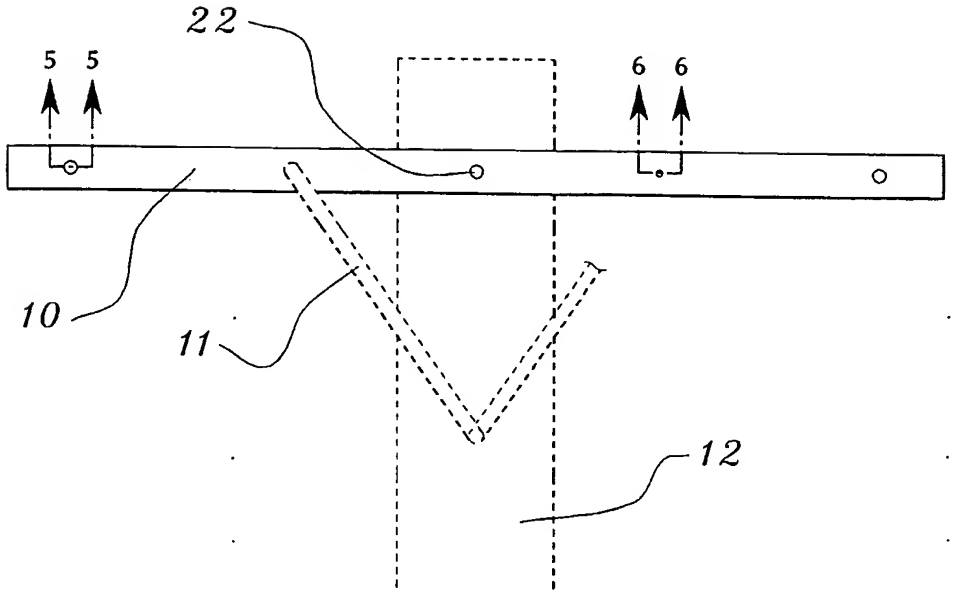


Fig. 2

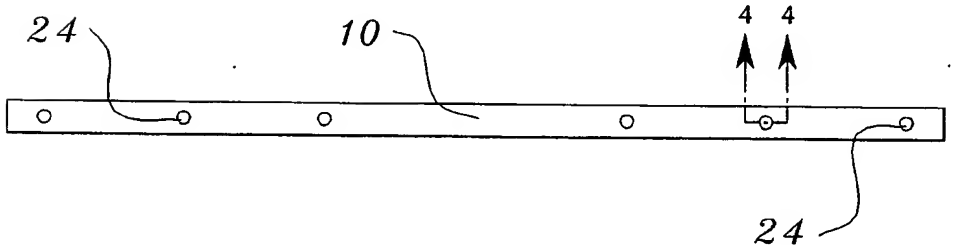
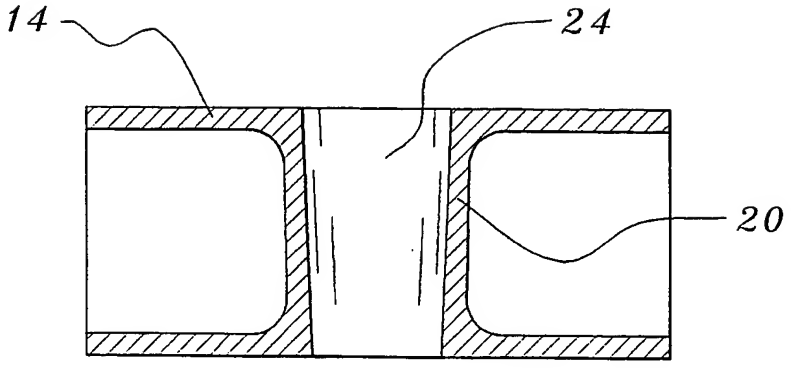
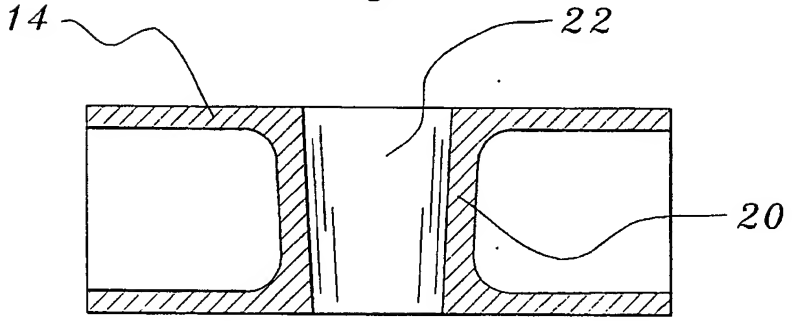


Fig. 3



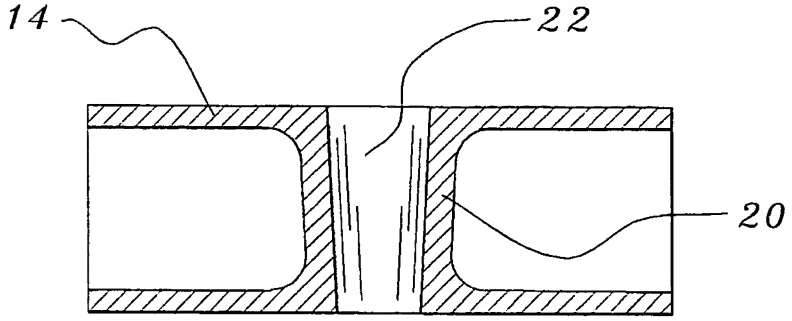
(VIEW 4-4)

Fig. 4



(VIEW 5-5)

Fig. 5



(VIEW 6-6)

Fig. 6

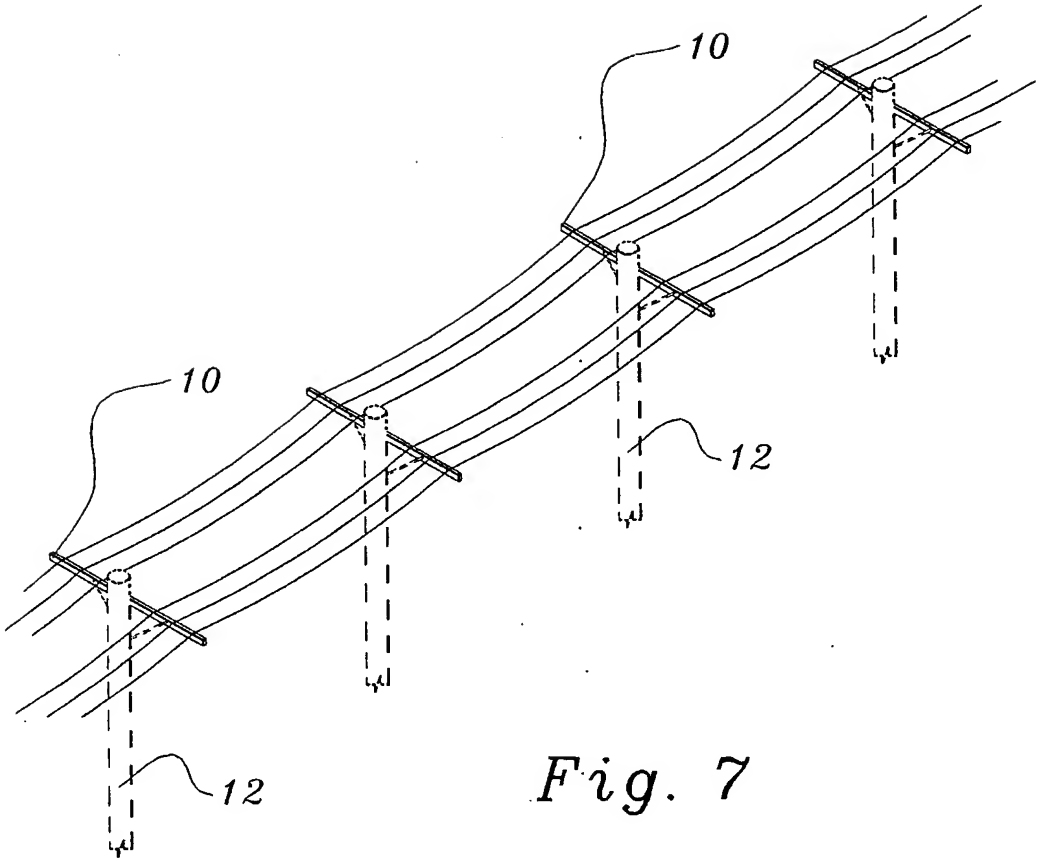


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/04201

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :E04H 12/02, 12/24; B28B 1/02
US CL :Please See Extra Sheet.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 428/36.8, 36.9, 36.91, 116, 119, 137; 52/40, 697, 736.2; 264/310, 312, 319

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST and WEST

utility adj1 pole, recycl$, binder, filler

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ---- Y	US 5,605,017 A (FINGERSON et al.) 25 February 1997, Figures 1,2; column 3, lines 13-32.	1,5,6,7,9 ---------- 1,5,6,7,9
Y	US 5,246,754 A (MILLER) 21 September 1993, Abstract; Figure 6; column 10, lines 14-29.	1,5,6,7,9
Y,P	US 5,889,119 A (CORAN et al.) 30 March 1999, Abstract; column 2, line 59 to column 3, line 53; column 7, lines 44-55; column 8, lines 3-8.	2,3,4,8
X	US 5,217,667 A (GRIFFITH) 08 June 1993, Abstract; Figure 3; column 2, lines 38-55; column 6, lines 3-31; column 8, lines 15.	10,11

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

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International application No.
PCT/US00/04201

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,675,956 A (NEVIN) 14 October 1997, Abstract; column 2, line 49 to column 3, line 42.	1-9
A	US 5,733,943 A (DOAN) 31 March 1998, Abstract; column 3, line 49 to column 5, line 36.	1-9
A	US 5,775,035 A (PAPIN) 07 July 1998, Abstract, Figures 2,4; column 3, line 63 to column 4, line 25.	1-9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/04201

A. CLASSIFICATION OF SUBJECT MATTER:
US CL :

428/36.8, 36.9, 36.91, 116, 119, 137; 52/40, 697, 736.2; 264/310, 312, 319